

# Fluid Power Formulas

## Cylinder Speed and Motor Torque

<b>Fluid Pressure</b> Pounds/Square Inch	Pressure=Force (pounds) /Unit Area (Square Inches)	<b><math>P=F/A</math> or <math>\text{psi}=F/A</math></b>
<b>Cylinder Area</b> Square Inches	Area= $\pi$ x Radius <sup>2</sup> inches  Area=( $\pi/4$ )x Diameter <sup>2</sup> inches	<b><math>A=\pi r^2</math></b>  <b><math>A=\pi D^2/4</math> or <math>A=0.785D^2</math></b>
<b>Cylinder Force</b> Pounds	Force= Pressure (psi) x Net Area (square inches)	<b><math>F=\text{psi} \times A</math> or <math>F=PA</math></b>
<b>Cylinder Speed</b> Feet/second	Velocity= (231 x Flow rate (gpm))/ (12x60xNet Area (square inches))	<b><math>V=231Q/720A</math> or <math>V=0.3208Q/A</math></b>
<b>Cylinder Volume Capacity</b>  Gallons	Volume=( $\pi$ xRadius <sup>2</sup> (inches)x Stroke (inches) )/231  Volume=Net Area (square inches) X Stroke (inches)/231	<b><math>V=\pi r^2 L/231</math></b>  <b><math>V=AL/231L=\text{stroke length}</math></b>
<b>Cylinder Flow Rate</b> Gallons per minute	Flow Rate=(12x60xVelocity(feet/sec) xNet Area(square inches))/231	<b><math>Q=720vA/231</math> or <math>Q=3.117vA</math></b>
<b>Fluid Motor Torque</b> Inch pounds	Torque=(Pressure(psi) x F.M.Displacement(cubic inch/rev)) $2\pi$ Torque=(Horsepowerx63025/RPM Torque=Flow Rate(gpm)xPressure(psi) x36.77/RPM	<b><math>T=\text{psi } d/2\pi</math> or <math>T=Pd/2\pi</math></b>  <b><math>T=63025 \text{ HP}/n</math></b>  <b><math>T=36.77QP/n</math> or <math>T=36.77\text{psi}/n</math></b>
<b>Fluid Motor Torque/100psi</b> Inch pounds	Torque/100psi=F.M. Displacement (cubic inches/rev)/.0628	<b><math>T_{100\text{psi}}=d/.0628</math></b>
<b>Fluid Motor Speed</b> Revolutions/Minute	Speed=231 x Flow rate (gpm)/F.M. Dis- placement (cubic inches /revolution)	<b><math>n=231Q/d</math></b>
<b>Fluid Motor Power</b> Horsepower Output	Horsepower=Torque Output (inch pounds) x RPM/63025	<b><math>HP=Tn/63025</math></b>
<b>Pump Outlet Flow</b> Gallons per Minute	Flow= RPM x Pump Displacement (cubic inches/revolution)/231	<b><math>Q=nd/231</math></b>
<b>Pump Input Power</b> Horsepower required	Horsepower <sub>input</sub> =Flow Rate Output (gpm) x Pressure (psi)/1714 x Efficiency	<b><math>H_{p_{in}}=QP/1714\text{Eff}</math> or <math>H_{p_{in}}=\text{GPM} \times \text{psi}/1714\text{Eff}</math></b>
<b>Flow Rate Through Pipe</b> Feet/Second	Velocity=0.3208 x Flow rate Through I.D. (gpm)/Internal Area (square inches)	<b><math>V=0.3208/A</math></b>
<b>Compressibility of Oil</b>  Additional Oil required to reach Pres-	Additional Volume=Pressure(psi) xVolumeof Oil Under Pres- sure/250,000	<b><math>V_A=PV/250,000</math></b>  <b>Approximately 1/2% per 1000 psi</b>

## COMMON CONVERSIONS

TO CONVERT	INTO	MULTIPLY BY
BAR	PSI	14.5
cc	Cu.In.	0.66120
°C	°F	(°C x 1.8) + 32
Kg	lbs.	2.205
KW	HP	1.341
Liters	Gallons	0.2642
mm	Inches	0.03937
Nm	lb.-ft.	0.7375
Cu. in.	cc	16.39
°F	°C	(°F-32) ÷ 1.8
Gallons	Liters	3.785
HP	KW	0.7457
Inch	mm	25.4
lbs.	Kg	0.4536
lb-ft.	Nm	1.356
PSI	BAR	0.06896